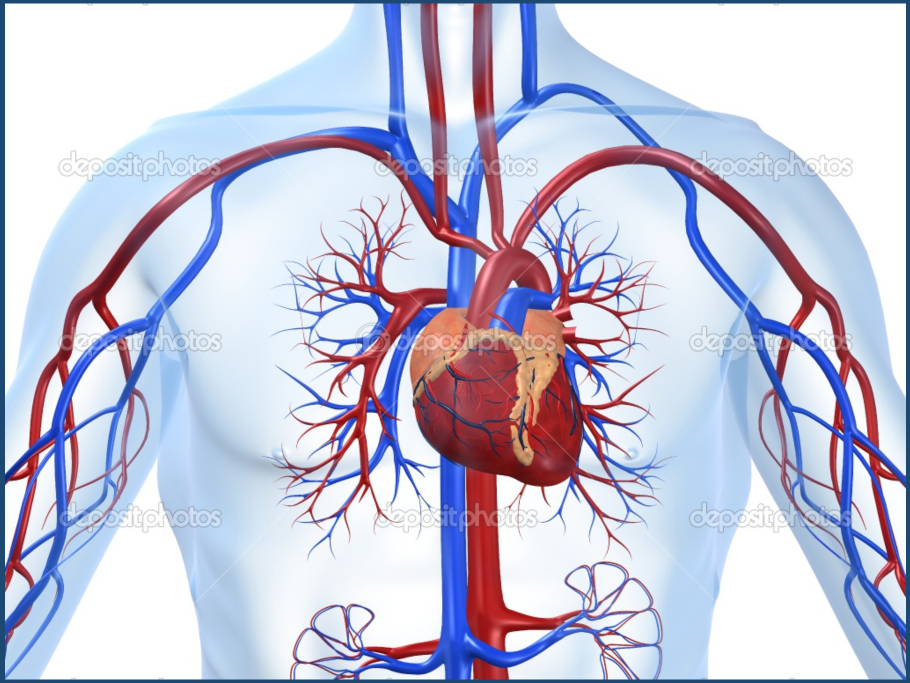
Impact of Playing Level on Vascular Adaptations in Rugby League Players



Dale Read & Gladys Onambele-Pearson
Manchester Metropolitan University

Background

‘Athlete’s heart’ is a generally accepted term, and has been used as a benchmark to characterize athletic status (George, 1999).

Is there sufficient evidence for the existence of an ‘athletes artery’?

Naylor (2006)
Rowley (2011)
Rowley (2012)
Rowley (2012b)
Schmidt-Trucksass (2000)
Walther (2008)

Welsch (2013)
Schmidt-Trucksass (2003)

What about sports that combine endurance and resistance training?

Aim & Hypothesis

‘The impact of distinct forms of exercise on arteries, exemplified in comparisons between strength/power and endurance athletes, have not been specifically investigated but may provide important insights’ (Green, 2012, p.301).

Therefore…

To assess peripheral vascular parameters in professional rugby league players in comparison to sex- and age-matched university rugby league players.

It was hypothesised that the professional players would demonstrate a superior vascular adaptation.

Participants

(PG) Professional (*n* = 9)
5 Backs, 4 Forwards
4 ± 2 years
12 h.wk^{-}1

(UG) University (*n* = 9)
5 Backs, 4 Forwards
3 ± 1 years
8 ± 2 h.wk^{-}1

Both groups used the same types of training which included, ‘on field’ team training, sport specific fitness training and resistance training.
Both groups were assessed in-season.

Methods

DEXA scan to establish whole-body and limb-specific adipose and lean tissue mass.

Doppler ultrasonography used to assess HR, vessel diameter and blood flow in the carotid artery at rest and following a sport specific exercise protocol.

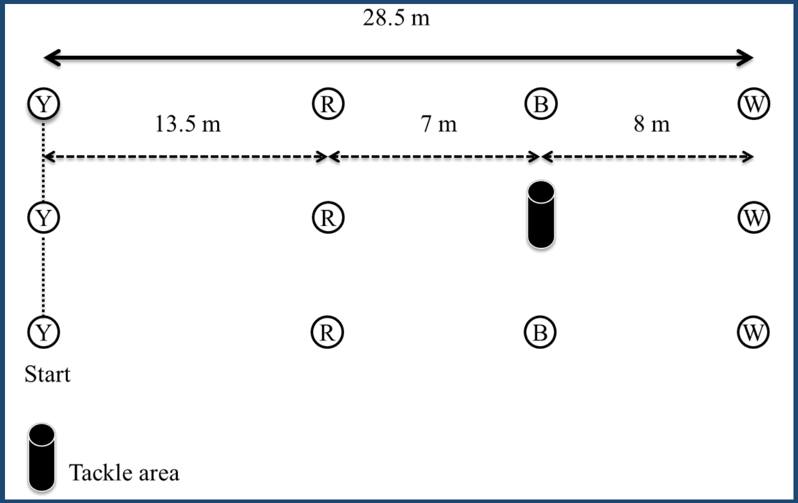


FIGURE 1. (RLMSP-i) Rugby League Movement Simulation Protocol for interchanged players (Waldron, 2013).

Results

TABLE 1. Anthropometric and physiological characteristics

	Professional	University	Comparison
Age (years)	22 ± 3	23 ± 2	NS
Height (cm)	186 ± 8	180 ± 5	NS
Body mass (kg)	96 ± 13	87 ± 10	NS
Body mass index (kg/m^2)	27.9 ± 1.6	26.9 ± 2.5	NS
Body fat (%)	15.8 ± 2.8	21.1 ± 6.1	$P = 0.021$
Fat free mass (kg)	79 ± 9	67 ± 6	$P = 0.005$
Systolic blood pressure (mmHg)	123 ± 12	134 ± 10	$P = 0.046$
Diastolic blood pressure (mmHg)	62 ± 4	76 ± 8	$P = 0.001$
Blood glucose (mmol/L)	5.2 ± 0.2	5.2 ± 0.4	NS
Urine osmolality (mOsmol/kg)	559 ± 234	707 ± 224	NS

Data are presented as mean ± SD. NS, nonsignificant.

TABLE 2. GPS and HR data from during the RLMSP-I

	Professional	University	Comparison
Total distance (m)	2316.7 ± 22.4	2364.0 ± 23.6	NS
Metres per minute ($m.min^{-1}$)	100.2 ± 1.7	99.4 ± 2.3	NS
Maximum speed ($m.s^{-1}$)	7.0 ± 0.2	6.8 ± 0.4	NS
Average heart rate (bpm)	150 ± 14	164 ± 10	$P = 0.025$
Maximum heart rate (bpm)	186 ± 9	192 ± 5	NS

Data are presented as mean ± SD. NS, nonsignificant.

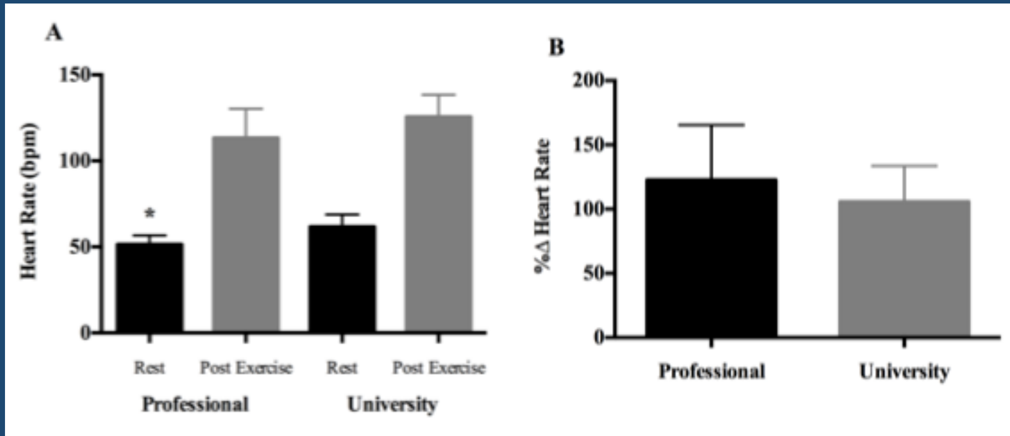


FIGURE 2. CA Heart Rate

PG was lower at rest (51 ± 5 vs. 62 ± 7 bpm, *P* = 0.003) but not post exercise (113 ± 17 vs. 126 ± 13 bpm, *P* > 0.05). Relative increase in HR (123 ± 43 vs. 106 ± 28 %) was not significant (*P* > 0.05).

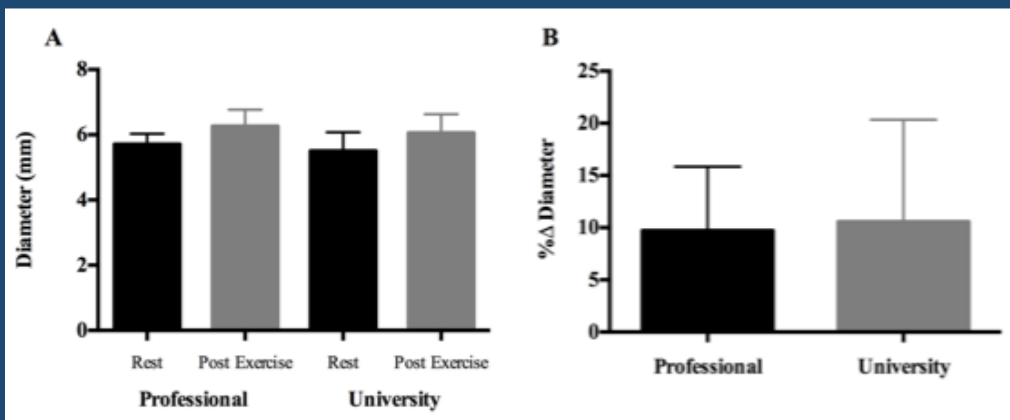


FIGURE 3. CA Diameter

Not significantly different at either rest (5.7 ± 0.3 vs. 5.5 ± 0.6 mm, *P* > 0.05) or post exercise (6.3 ± 0.5 ± 6.1 ± 0.6 mm, *P* > 0.05). The two groups also had a similar relative increase in diameter (10 ± 6 vs. 11 ± 10 %, *P* > 0.05).

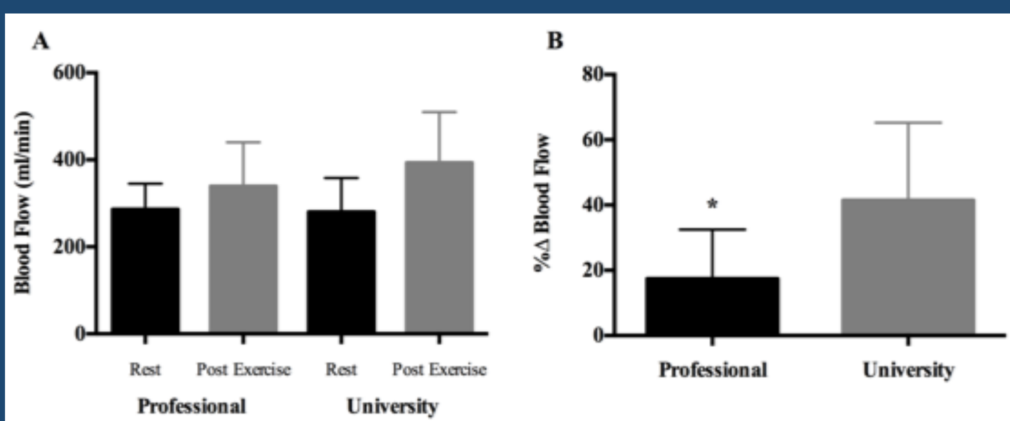


FIGURE 4. CA Blood Flow

Not significantly different at either rest (286.2 ± 59.1 vs. 258.1 ± 89.9 ml/min, *P* > 0.05) or post exercise (339.0 ± 101.0 ± 393.2 ± 116.8 ml/min, *P* > 0.05). The UG had a significantly greater relative increase in blood flow (17 ± 15 vs. 42 ± 24 %, *P* = 0.021).

Results

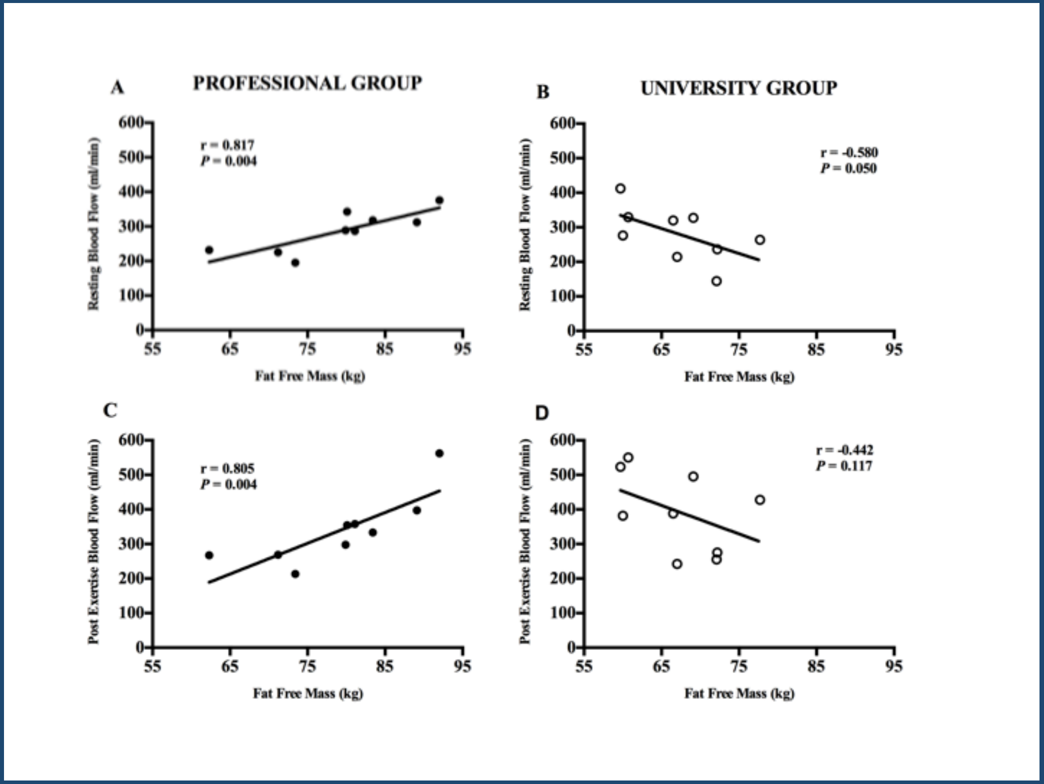


FIGURE 5. Correlations between resting or post exercise blood flow and FFM in the PG (A and C; closed circles) and in the UG (B and D; open circles).

Discussion

The assessment of a number of arteries may have revealed different results (Rowley 2011, 2012, 2012b). FMD.

Increased general fitness of the PG; Training intensity and volume (Gabbett, 2000). Increased VO_{2max} (Gabbett, 2005). Greater frequency of high intensity sprints during games (Gabbett, 2013).

Repetitive shear stress, subsequent endothelial nitric oxide synthase expression and nitric oxide release is the most powerful stimuli for vascular adaptations (Tinken, 2010).

Rowley (2012) showed a significant positive association between arterial diameter of the SFA and BA and FFM.

Further investigation into the association between vascular parameters and FFM including longitudinal studies with the addition of a (sedentary control) group.

Individual variability with only 9 participants in each group.

Conclusion

The data are the first to suggest the existence of chronic vascular adaptations to playing rugby league, improving from university to professional level in that the professional players display:

- A significantly lower heart rate at rest (P = 0.003).
- A significantly lower average heart rate for the same given exercise (P = 0.025).
- A positive association between blood flow and FFM at rest and post exercise.

Acknowledgements

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